

BRIDGING CORPUS LINGUISTICS AND GRAMMATICAL ACCURACY IN EFL WRITING: EVIDENCE FROM RURAL INDONESIAN VOCATIONAL STUDENTS

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Article Info	Abstract
Article History Received: April 2026 Revised: June 2026 Accepted: August 2026 Published: October 2026	<i>Grammar accuracy remains a persistent challenge for vocational EFL learners, particularly in rural Indonesian contexts where opportunities to engage with authentic language use may be limited. This study examined changes in grammatical error frequency following Corpus of Contemporary American English (COCA)-assisted Data-Driven Learning (DDL) in procedural text writing. A pretest–posttest design was employed with 76 eleventh-grade vocational high school students in Rokan Hilir, Riau, Indonesia. Students completed grammar-oriented procedural writing tasks before and after the intervention. Grammatical performance was assessed through error counts across five categories: nouns, verbs, adjectives, articles, and prepositions. Descriptive statistics and a paired-samples t-test were used to examine pretest–posttest changes. The mean number of grammatical errors decreased from 35.80 (SD = 31.65) to 30.00 (SD = 27.48), representing a mean reduction of 6.00 errors. The paired-samples t-test indicated a statistically significant difference between the pretest and posttest, $t(75) = 7.755, p = .001$. At the category level, total errors decreased from 179 to 150, with the largest reductions occurring in article and verb errors. These findings indicate improved grammatical performance following the intervention. However, because the analysis was based on a pretest–posttest comparison and did not establish a valid between-group effect, the improvement cannot be attributed exclusively to COCA-assisted instruction. The findings suggest that COCA may serve as a supplementary resource for grammar and procedural writing instruction when combined with teacher guidance, explicit instruction, and sustained practice.</i>
Keywords Corpus of contemporary american English; Data-driven learning; EFL writing; Grammar mastery; Procedural text;	
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INTRODUCTION

Mastery of grammar constitutes a foundational pillar of English writing ability because it operates as the primary system through which meaning, coherence, and clarity are constructed in written texts. From a functional linguistics perspective, grammar is not merely a set of formal rules but a resource for meaning-making that enables writers to organize ideas logically and convey intentions precisely (Halliday & Hasan, 2014). This role becomes particularly salient in functional genres, where linguistic choices are closely tied to communicative purposes. Empirical studies consistently demonstrate that grammatical accuracy significantly correlates with writing quality, readability, and communicative

effectiveness, especially in instructional and academic texts (Cheng & Zhang, 2021; Sato, 2022). Without sufficient grammatical control, even well-developed ideas risk being misinterpreted or losing their intended impact.

Within the context of English as a Foreign Language (EFL), grammar acquisition faces structural constraints related to limited exposure to authentic language use. Learners often encounter English primarily in classroom settings, resulting in grammar knowledge that is largely declarative rather than procedural. While students may recognize rules explicitly, they frequently struggle to apply them flexibly in meaningful writing tasks (Çelik & Baturay, 2024). Recent EFL research by Özer and Özbay (2022); & Zhong and Wakat (2023) indicate that this gap between knowing grammar and using grammar persists in writing performance, where learners tend to rely on isolated sentence construction instead of cohesive textual organization. Otherwise, As discovered by Rasyidah et al. (2025), students frequently omit required verbs in instructional steps, misuse articles and demonstrate inconsistent application of transition signals. As a consequence, grammatical forms are produced inaccurately or inconsistently when learners attempt to express complex ideas in contextually appropriate ways.

Moreover, empirical evidence from Indonesian Vocational High Schools, particularly in rural areas, reinforces this challenge. Classroom-based studies reveal that grammatical errors continue to dominate students' Procedure text, reflecting persistent difficulties in applying grammar for functional communication. Common problems include inaccurate use of imperative verbs, inappropriate or missing sequencing conjunctions such as first, then, and finally, as well as inconsistent verb forms across instructional steps (Lu, 2025; Sun & Park, 2023). Also, Pamuji et al. (2025) notion that unlike learners in urban settings who may have greater access to digital learning resources, students in rural vocational schools often encounter English primarily through textbooks and teacher-centered classroom instruction. Consequently, grammar learning tends to emphasize memorization of rules rather than observation of language as it is naturally used in authentic communicative contexts.

Additionally, the procedural text genre itself inherently demands a high level of grammatical precision due to its communicative function of delivering clear, systematic, and unambiguous instructions. Errors in tense, verb form, or logical sequencing can distort meaning and potentially lead to misunderstanding of the intended procedures. Genre-based theory emphasizes that linguistic accuracy in Procedure text is inseparable from their social purpose, as readers rely on grammatical signals to interpret order, obligation, and action (Nagao, 2019; Zhang & Zhang, 2021). Therefore, strengthening grammatical mastery within this genre is not a peripheral concern but a central requirement for effective written communication, particularly for vocational students who are expected to apply English in real-world, task-oriented contexts.

Moreover, grammar instruction in many EFL classrooms remains dominated by decontextualized, rule-based teaching that treats grammar as a set of abstract forms detached from communicative use. This approach, while efficient for presenting structures, has been widely criticized for its limited impact on learners' ability to apply grammar meaningfully in real discourse. Empirical studies as discovered by Caffrey et al. (2024); Cheng and Zhang (2021) & Putra et al. (2021) have consistently show that students taught through isolated rules often demonstrate declarative knowledge without corresponding procedural competence, resulting in low accuracy and fluency in authentic communication. Such conditions create a pedagogical gap between what learners know about grammar and how they use it, indicating the need for instructional models that foreground function, frequency, and contextualized meaning rather than prescriptive explanations alone (Suhandoko et al., 2025).

Contemporary pedagogical perspectives, particularly usage-based learning, offer a theoretically grounded response to this problem by conceptualizing grammar as emerging

from repeated exposure to meaningful language use. From this perspective, grammatical knowledge develops through sensitivity to patterns, constructions, and distributions found in authentic input (Crogman et al., 2025; Lu et al., 2025). Within this framework, the Corpus of Contemporary American English (COCA) represents a powerful linguistic resource, as it provides large-scale, empirically grounded evidence of grammar in use across genres and registers. Unlike textbook examples, corpus data reflect actual language behavior, allowing learners to observe how grammatical forms function pragmatically and variably in real contexts. Recent applied linguistics research confirms that corpus-informed instruction enhances learners' grammatical accuracy, lexical-grammatical awareness, and register sensitivity (Lu, 2025; Rodríguez-Fuentes & Swatek, 2022; Zhong & Wakat, 2023).

The pedagogical value of COCA is further strengthened when aligned with data-driven learning (DDL), which positions learners as active analysts who discover grammatical regularities through guided exploration of authentic data. DDL shifts grammar learning from passive rule reception to inductive pattern noticing, a process strongly supported by the Noticing Hypothesis (Leow, 2019). Yet, Corpus exploration tasks encourage such noticing by making frequency, collocation, and contextual variation salient, thereby facilitating deeper cognitive engagement with form–meaning relationships. Recent classroom-based studies by Fang and Abdullah, (2024); Rodríguez-Fuentes and Swatek (2022) & Suhandoko et al. (2025) demonstrate that integrating COCA-driven DDL activities significantly improves learners' ability to notice, interpret, and internalize grammatical patterns, especially in advanced and tertiary EFL contexts. Collectively, these suggest that corpus-based grammar instruction is not merely a technological innovation, but a theoretically coherent and empirically supported approach to addressing long-standing limitations in grammar pedagogy.

Furthermore, rural Indonesian classrooms deserve greater scholarly attention within corpus-based language learning research because they present unique pedagogical and technological conditions that differ considerably from those reported in urban and higher-education settings. Although digital infrastructure has gradually improved across many regions of Indonesia, disparities in internet connectivity, device availability, and digital literacy continue to influence classroom practices (Lin et al., 2025; Murshed, 2026). Teachers often face challenges in integrating technology-enhanced instruction due to limited professional development opportunities, while students may possess varying levels of readiness to engage with data-driven learning activities. Corpus tools such as the Corpus of Contemporary American English (COCA) require learners to navigate concordance lines, identify linguistic patterns, and draw grammatical generalizations independently.

Despite the growing body of evidence supporting corpus-based language learning, significant gaps remain in the literature. Most studies investigating Data-Driven Learning (DDL) and the Corpus of Contemporary American English (COCA) have been conducted in higher education settings and have predominantly focused on vocabulary acquisition, collocational competence, academic writing, or general grammar development among university learners (Boulton & Cobb, 2017; Lu, 2025; Sun & Park, 2023). Comparatively little attention has been devoted to vocational secondary education, where students face distinct linguistic and professional communication demands. In Indonesian Vocational High Schools (SMK), English instruction is expected to support workplace-oriented communication; therefore, Cheng & Zhang (2021) and Sato (2022) confirm that the grammatical accuracy in functional genres such as procedural texts becomes a critical competency. Nevertheless, empirical research examining how corpus-based instruction can improve grammar performance within vocational writing contexts remains scarce.

The lack of research is even more evident in rural educational environments. Rural Indonesian classrooms continue to encounter challenges related to unequal digital access, limited exposure to innovative language-learning technologies, insufficient teacher training in

corpus pedagogy, and varying levels of learner digital literacy. These contextual realities may influence the effectiveness of corpus-assisted instruction and shape learners' readiness to engage in inductive language learning (Taye & Mengesha, 2024). However, existing corpus-based studies have largely been conducted in urban schools or universities with relatively stronger technological infrastructure, leaving rural vocational learners underrepresented in the corpus linguistics literature. As a result, there is limited understanding of how corpus-informed grammar instruction operates in educational settings where technological resources and pedagogical support are more constrained.

The present study addresses this gap by examining the implementation of COCA-based Data-Driven Learning (DDL) for grammar instruction in procedural text writing among vocational high school students in rural Indonesia. Its novelty lies in three aspects: focusing on vocational secondary learners rather than university students, emphasizing grammatical accuracy within a genre-based writing context, and providing empirical evidence from an underrepresented rural setting. By integrating corpus linguistics, genre-based pedagogy, and vocational EFL education, this study contributes to understanding how authentic language data can support grammar development in contexts where access to innovative language learning resources remains limited.

Investigating COCA-based DDL in rural vocational schools is both theoretically and pedagogically important. Theoretically, it extends research on usage-based learning and the Noticing Hypothesis by exploring their application in environments with limited authentic input and varying levels of digital readiness (Candarli & Deignan, 2025; Rodríguez-Fuentes & Swatek, 2022; Sarker et al., 2019). Practically, it offers insights into adapting corpus-informed pedagogy to improve grammar instruction for vocational learners who require accurate procedural communication skills. In doing so, this study addresses an important gap in corpus-based EFL research and provides evidence from a context that remains largely underrepresented in the literature.

Accordingly, the present study is designed with an explicit operational objectives: (1) Is there a statistically significant difference in students' grammatical error scores between the pretest and posttest following COCA-assisted instruction?; (2) What changes occur in the frequency and distribution of grammatical errors in students' procedural writing following COCA-assisted instruction?. Beyond testing effectiveness, this research offers several key contributions. It extends the application of corpus-based learning to the vocational secondary education context, provides empirical evidence on the effectiveness of COCA for genre-based grammar instruction, and generates practical implications for EFL teachers seeking to design contextual, authentic, and data-informed grammar learning experiences. By situating corpus use within genre pedagogy, this study responds to contemporary calls for more inclusive, context-sensitive, and practice-oriented corpus research in EFL education.

RESEARCH METHOD

Research Design

This study used a pretest–posttest design to examine changes in students' grammatical errors after using Corpus of Contemporary American English (COCA)-assisted Data-Driven Learning (DDL) in EFL procedural writing. The study was conducted in March 2025 at a rural vocational high school in Rokan Hilir, Riau, Indonesia. COCA was used to provide authentic language examples to help students learn grammar and improve their procedural writing. This design was suitable because random assignment can be difficult in educational settings, while instructional effects can still be examined systematically (Creswell & Creswell, 2023). The analysis included students who had both pretest and posttest grammatical-error scores. Therefore, the Results section focuses on changes in grammatical errors within the same participants from pretest to posttest. Although the broader study included an experimental group that received COCA-supported grammar instruction and a control group

that received conventional grammar instruction, the available results only included pretest and posttest scores from the experimental group. Thus, this study does not compare the experimental and control groups. The rural setting is also important because students in non-urban areas may have limited access to educational technology and digital learning resources. Using corpus-assisted instruction in this context provides empirical evidence for discussions of digital equity and context-sensitive language learning (Al-Qahtani, 2021; Bansal & Choudhary, 2024).

Research Participants

The study was conducted at Vocational High School Sempena Kubu Babussalam, Rokan Hilir, Riau, Indonesia, during the 2024/2025 academic year. The participants were 76 eleventh-grade students from two vocational programs: Computer and Network Engineering (TKJ) and Plantation Agribusiness (ATP). Purposive sampling was used based on the English teacher's recommendation, with TKJ students assigned to the experimental group and ATP students to the control group Mutiara et al. (2023) and Noor et al., (2022). The participants had prior experience with English grammar and writing activities. The school was selected because it provided adequate technological facilities, including internet access and a language laboratory, to support the use of the Corpus of Contemporary American English (COCA). The inclusion of procedural writing in the English curriculum also made the setting relevant for examining corpus-based grammar and writing instruction.

Instruments

The primary instrument was a grammar-oriented procedural writing task used to assess students' grammatical accuracy before and after the intervention. Students produced a 150–200-word procedural text on a familiar vocational topic in both the pretest and posttest. Consistent with genre-based pedagogy, the task assessed grammatical use in meaningful written communication rather than through isolated sentences or discrete-item exercises. Student performance was analyzed using an analytic error-analysis procedure covering five grammatical categories: nouns, verbs, adjectives, articles, and prepositions. These categories corresponded to the grammatical features examined in the study and reported in the Results section. The assessment indicators and descriptions are presented in Table 1.

Table 1
Grammar Assessment Categories and Indicators

No.	Grammar Indicator	Description
1.	Nouns	Appropriate form and use of nouns in the procedural text
2.	Verbs	Appropriate verb forms and grammatical use of verbs in procedural instructions
3.	Adjectives	Appropriate form and use of adjectives to describe objects, materials, or actions
4.	Articles	Appropriate use of definite and indefinite articles
5.	Prepositions	Accurate use of prepositions in procedural contexts

Grammatical performance was assessed by counting errors in procedural texts across five categories: nouns, verbs, adjectives, articles, and prepositions. Each error occurrence was counted separately, with lower frequencies indicating greater grammatical accuracy. This error-based scoring enabled direct comparison of pretest–posttest changes based on observed error frequencies. Besides, content validity was established through expert review by three specialists in Applied Linguistics, English Language Teaching, and Writing Assessment, yielding a CVI of 0.89. Instrument reliability was supported by Cronbach's alpha of 0.87, while inter-rater reliability between two trained raters reached Cohen's Kappa of 0.82, indicating substantial agreement. These results confirmed the instrument's validity and

reliability for assessing grammatical accuracy (Taherdoost, 2016). Therefore, the five coding categories were consistently applied across the instrument, coding procedure, analysis, and Results section to ensure methodological consistency.

Data Analysis

Data analysis was conducted to examine changes in students' grammatical error frequency following the implementation of Corpus of Contemporary American English (COCA)-assisted Data-Driven Learning (DDL) in EFL procedural writing (Sato, 2022). The study employed a pretest–posttest design involving 76 participants. First, descriptive statistics were calculated for the pretest and posttest grammatical-error scores, including the mean, standard deviation, minimum, and maximum scores. Grammatical errors were also examined by category to identify changes in the frequency and distribution of errors following the intervention.

Before the hypothesis testing, the normality of the pretest and posttest scores was examined using the Shapiro–Wilk test. The reported significance values were .185 for the pretest and .440 for the posttest. Since both values were greater than .05, the data were considered normally distributed and met the assumption for parametric analysis. Following the normality test, a paired-samples t-test was conducted to determine whether the difference between students' pretest and posttest grammatical-error scores was statistically significant. This test was appropriate because the same 76 participants completed both the pretest and posttest. The significance level was set at $\alpha = .05$, with 75 degrees of freedom ($df = 76 - 1$), thereby satisfying the assumptions required for parametric statistical procedures which was adopted from the works of Ningsih et al. (2025) and Zhou et al. (2023).

The analysis focused on whether grammatical error frequency changed after the implementation of COCA-assisted DDL. Therefore, no independent-samples t-test or between-group comparison was conducted. The final paired-samples t-test results should be calculated from the complete set of 76 pretest–posttest scores to ensure that the reported mean difference, standard deviation, standard error, t value, confidence interval, and significance value accurately represent the data (Fuadah et al., 2023).

RESEARCH FINDINGS AND DISCUSSION

Research Findings

This study investigated whether COCA-assisted grammar instruction was associated with improved grammatical accuracy among vocational high school students writing procedural texts. The findings showed a reduction in overall grammatical errors from the pretest to the posttest, with the largest decreases occurring in verb and article errors. These descriptive changes suggest that corpus-based learning may have enhanced students' awareness of grammatical patterns. Before examining changes in grammatical performance, the normality of the pretest and posttest scores was assessed using the Shapiro–Wilk test to ensure that the data met the assumptions required for parametric analysis, as presented in Table 2.

Table 2
Normality Test Results Using Shapiro-Wilk

	Tests of Normality					
	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre-Test Experiment	.249	76	.200	.847	76	.185
Post-Test Experiment	.214	76	.200	.905	76	.440

. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

According to table above, the normality of the pretest and posttest data was examined using the Shapiro–Wilk test. As shown in Table 2, for the 76 reported observations, the pretest produced a significance value of .185, while the posttest produced a significance value of .440. Both values exceeded the .05 criterion, indicating that the normality assumption was satisfied for the reported scores. Accordingly, a paired-samples t-test was used to compare students' pretest and posttest grammatical-error scores. Moreover, the descriptive statistics were calculated to summarize students' grammatical performance before and after the treatment. The results are presented in Table 3.

Table 3
Descriptive Statistics

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Pre-Test Experiment	76	1	70	35.80	31.65
Post-Test Experiment	76	4	62	30.00	27.48

The descriptive results showed a reduction in the number of grammatical errors following the COCA-assisted instructional intervention. The pretest scores for the 76 students ranged from 1 to 70, with a mean of 35.80 (SD = 31.65). The posttest scores ranged from 4 to 62, with a mean of 30.00 (SD = 27.48). Because lower scores represented fewer grammatical errors, the difference between the two means indicates a descriptive reduction in average grammatical-error frequency from the pretest to the posttest. The reduction was 5.80 errors on the reported mean score. The relatively large standard deviations indicate substantial variation in students' grammatical performance. Thus, although the mean error score decreased, individual students did not necessarily demonstrate the same degree of change.

Therefore, to provide a more detailed overview of students' grammatical performance, the total number of errors was classified by grammatical category as presented in the following table.

Table 4
Pre-test and Post-test error Counts

Types of errors	Pre-test errors counts	Post-test errors counts	Change
Noun (N)	31	29	-2
Verb (V)	70	62	-8
Adjectives (Adj)	4	1	-3
Articles (A)	67	53	-14
Preposition (Pre)	7	5	-2
Total	179	150	-29

Table 4 presents the distribution of errors in the pretest and posttest across five grammatical components: nouns, verbs, adjectives, articles, and prepositions. Overall, The category-level analysis also showed a reduction in the total number of reported grammatical errors. The aggregate number of errors decreased from 179 in the pretest to 150 in the posttest. The largest numerical reductions were observed in verb and article errors. Verb errors decreased from 70 to 62, while article errors decreased from 67 to 53. Noun errors decreased from 31 to 29, adjective errors decreased from 4 to 1, and preposition errors decreased from 7 to 5. These descriptive results indicate that the greatest reductions occurred in verb and article usage, whereas adjective errors were already relatively infrequent in the pretest and remained low in the posttest. The results are presented in Table 5.

Table 5
Paired Samples T-Test

Paired Samples Test								
Paired Differences								
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
				Lower	Upper			
Pre-Test Experiment - Post-Test Experiment	6.000	6.745	0.774	4.459	7.541	7.755	75	.001

The data met the normality assumption, allowing the use of a paired-samples t-test. The results showed a decrease in grammatical errors from the pretest to the posttest, with a mean difference of 6.000. The t-test showed that this decrease was statistically significant, $t(75) = 7.755$, $p < .001$. This indicates a significant improvement in students' grammatical performance after the treatment. The decrease in grammatical errors, especially in verb and article use, may be related to students' increased attention to common grammatical patterns found through corpus exploration. This finding supports the Noticing Hypothesis (Leow, 2019), which suggests that noticing language forms can improve learners' awareness and use of those forms. Exposure to authentic language patterns through corpus exploration may therefore have helped students use grammar more accurately in their writing. Overall, the findings show significant improvement in grammatical performance after COCA-assisted instruction. The reduction in grammatical errors suggests that exposure to authentic language patterns may have improved students' grammatical awareness. However, because the study used a single-group pretest–posttest design, the improvement cannot be attributed solely to COCA-assisted instruction. Other factors, such as classroom instruction, student engagement, and writing practice, may also have contributed to the improvement. Therefore, the findings indicate a positive association between COCA-assisted instruction and grammatical improvement, but stronger causal claims require a controlled or comparative study.

Discussion

The findings of this study offer important insights into how COCA-assisted instruction may contribute to grammatical development among vocational high school students in EFL contexts. Since the paired-sample t-test revealed a statistically significant improvement between the pretest and posttest scores, the descriptive reduction in overall grammatical errors, particularly in verb and article usage, indicates a meaningful shift in learners' engagement with grammatical forms. Within the framework of Data-Driven Learning (DDL), language learning is viewed as an inductive process in which learners actively construct knowledge through the examination of authentic linguistic evidence rather than through the passive reception of grammatical rules (Boulton & Cobb, 2017). Since this allowed students to observe how language functions in real communicative contexts, its process aligns with usage-based learning theory, which maintains that linguistic knowledge develops through repeated encounters with recurring patterns of language use (Han & Ellis, 2020). Therefore, the reduction in grammatical errors observed in this study may indicate that learners began to develop a deeper awareness of the grammatical conventions commonly employed in procedural texts, even if such development had not yet produced substantial gains in measurable performance.

A similar interpretation emerges when the findings are examined through the lens of the Noticing Hypothesis. According to Leow (2019), learners must first consciously notice linguistic forms before those forms can be integrated into their developing language system. Corpus-based activities are particularly valuable in this regard because they encourage

learners to compare authentic examples, identify recurring structures, and reflect on how grammatical choices contribute to meaning. The noticeable decline in verb and article errors suggests that students became increasingly attentive to language patterns that had previously been overlooked in their writing. However, the absence of statistical significance indicates that enhanced awareness alone may not be sufficient to produce immediate mastery. As grammar acquisition is a cumulative process that requires repeated exposure, practice, and meaningful application over time (Han & Ellis, 2020; Rodríguez-Fuentes & Swatek, 2022), it is reasonable to assume that learners were still in the early stages of internalizing the grammatical knowledge acquired through corpus exploration.

Although the reduction in verb and article errors suggests that COCA-assisted instruction contributed to learners' growing awareness of grammatical patterns, the present study appears to capture an earlier stage of language development characterized by increased noticing, pattern recognition, and grammatical awareness (Lu, 2025; Özer & Şükrü Özbay, 2022; Rodríguez-Fuentes & Swatek, 2022). A key distinction lies in the nature of the learning outcomes observed. While earlier studies primarily emphasized measurable gains in grammatical performance, the present study appears to capture an earlier stage of language development characterized by increased noticing, pattern recognition, and grammatical awareness. This distinction is theoretically significant because corpus-based learning is often assumed to produce immediate improvements in language accuracy, whereas the current findings suggest that its initial impact may be more cognitive than performance-based. In other words, learners may first develop the ability to identify and understand grammatical patterns before they are able to consistently apply them in their own writing. Such a developmental trajectory is consistent with the Noticing Hypothesis (Leow, 2019), which views awareness as a prerequisite for acquisition rather than an automatic indicator of mastery.

Another important difference concerns the educational context in which corpus-based instruction was implemented. Many studies reporting significant DDL outcomes have been conducted in university environments where learners generally possess stronger academic literacy, higher English proficiency, and greater experience with independent learning strategies (Lu, 2025; Özer & Şükrü Özbay, 2022). By contrast, the participants in the present study were vocational high school students from a rural EFL setting. Unlike university students, these learners may have had limited prior exposure to corpus tools, digital learning platforms, and inductive learning approaches. Consequently, a substantial portion of the instructional period may have been devoted not only to learning grammar but also to developing the procedural and analytical skills necessary for corpus consultation. This contextual difference suggests that corpus-based instruction may function differently across educational levels, producing slower but potentially meaningful developmental changes among younger or less experienced learners.

The findings also differ from previous research in terms of instructional conditions. Studies demonstrating significant improvements frequently implemented corpus-based learning over extended periods and often combined corpus exploration with intensive teacher guidance, structured discovery tasks, and systematic feedback (Rodríguez-Fuentes & Swatek, 2022). In contrast, the present study was conducted within the practical constraints of a vocational school classroom, where instructional time, technological resources, and opportunities for extended corpus engagement were more limited. According to Boulton & Cobb (2017), successful DDL implementation depends not only on access to corpus resources but also on learners' ability to interpret concordance data effectively. Without sufficient scaffolding, learners may struggle to transform linguistic observations into durable grammatical knowledge. Therefore, the result observed in this study may reflect contextual and pedagogical constraints rather than limitations of corpus-based learning itself.

Furthermore, the present findings contribute a perspective that is often underrepresented in the corpus-based learning literature, namely the implementation of COCA-assisted instruction in rural vocational education. Much of the existing DDL research has focused on higher education settings, where technological infrastructure and learner autonomy are generally more developed. In rural vocational contexts, however, learners frequently encounter additional challenges related to digital literacy, limited technological access, and reduced opportunities for independent language practice. These factors, as confirmed by Lu (2025), may influence how learners interact with corpus tools and how quickly they are able to benefit from them. Consequently, the current study extends existing knowledge by demonstrating that corpus-based instruction may generate observable reductions in grammatical errors even when statistically significant gains are not immediately achieved. This finding highlights the importance of evaluating DDL not only through short-term achievement measures but also through indicators of developing awareness and engagement with language.

Taken together, the present study suggests that the effectiveness of corpus-based instruction is highly dependent on contextual, pedagogical, and learner-related factors. Rather than contradicting earlier studies, the findings as supported by Al-Qahtani (2021); Cheng & Zhang (2021); Lu (2025) and Rodríguez-Fuentes & Swatek (2022), complement them by illustrating that grammatical development through corpus consultation may follow different trajectories across learning environments. In highly supported university settings, corpus-based instruction may lead more directly to measurable gains in accuracy. In contrast, in rural vocational EFL contexts, its initial contribution may be to cultivate noticing, grammatical awareness, and analytical engagement with authentic language data. From this perspective, the value of COCA-assisted instruction should not be assessed solely by immediate statistical outcomes but also by its capacity to establish the cognitive foundations upon which long-term grammatical development can be built.

Moreover, several contextual and methodological factors may help explain why the descriptive reduction in grammatical errors did not result in a statistically significant improvement. First, learner readiness and digital literacy appear to be important considerations in corpus-based instruction. Data-Driven Learning (DDL) requires learners to actively analyze authentic language data, identify patterns, and construct grammatical understanding through independent exploration. Such processes demand analytical thinking, learner autonomy, and familiarity with digital learning environments. However, vocational high school students in rural contexts may have limited prior experience with corpus tools and inquiry-based learning approaches, making it challenging to engage effectively with concordance data from the outset. As noted by Rasyidah et al., (2025) and Rintaningrum (2023), learners often require structured preparation before they can successfully participate in independent language analysis, while Basalamah (2026) and Košíková & Vašaničová (2025) highlight that digital readiness remains a significant challenge in many rural educational settings. Consequently, part of the instructional period may have been devoted to adapting to the technology rather than fully focusing on grammatical learning.

A second factor concerns the relatively short duration of the intervention. Corpus-based learning is grounded in usage-based theories of language acquisition, which emphasize that grammatical knowledge develops gradually through repeated exposure to authentic language patterns and sustained opportunities for practice. Therefore, the descriptive reduction in errors observed in this study may represent an initial stage of learning rather than fully consolidated grammatical development. Previous research suggests that learners often require extended engagement with corpus resources before noticeable improvements emerge in writing performance (Sun & Park, 2023; Taye & Mengesha, 2024). Within a limited instructional

period, students may begin noticing grammatical patterns without yet being able to consistently apply them in their written production.

The characteristics of the sample and the assessment procedures may have also contributed to the findings. Considerable variation in students' performance was evident across both testing occasions, indicating that learners responded differently to the instructional treatment. According to Creswell & Creswell (2023), variability among participants can reduce statistical power and make significant effects more difficult to detect. At the same time, conventional grammar tests may not fully capture the types of learning promoted by corpus-based instruction. Corpus exploration often enhances grammatical awareness, noticing, and metalinguistic understanding before these cognitive developments become visible in measurable writing outcomes (Burnett et al., 2020). Therefore, the non-significant result may reflect not only the magnitude of learning gains but also the limitations of product-oriented assessment in measuring the underlying learning processes fostered by DDL.

Furthermore, the rural educational context may have influenced the effectiveness of the intervention. Although the participating school possessed the basic technological resources necessary to access COCA, broader issues related to infrastructure and digital access can affect the quality of learners' engagement with corpus-based activities. Research has shown that technological inequalities remain a challenge in rural educational environments, potentially limiting students' opportunities to interact extensively with digital learning tools (Bansal & Choudhary, 2024; Golzar et al., 2024). Under such conditions, the pedagogical benefits of corpus-based instruction may not be fully realized.

Finally, the findings highlight the critical role of teacher scaffolding in corpus-assisted learning. While DDL promotes learner autonomy, effective corpus consultation is rarely self-explanatory for novice learners. Students often require explicit guidance to interpret concordance lines, recognize grammatical patterns, and transfer their observations into meaningful writing practices. Boulton & Cobb (2017) argue that teacher support remains a fundamental component of successful corpus-based pedagogy, particularly during the initial stages of implementation. Similarly, Bereczki & Kárpáti (2021) emphasize that scaffolded instruction can reduce cognitive demands and facilitate more effective pattern discovery. Therefore, the limited improvement observed in this study may partly reflect the need for stronger instructional support alongside corpus exploration activities. Collectively, these factors suggest that the outcomes of COCA-assisted grammar instruction are influenced not only by the corpus itself but also by learner readiness, instructional duration, assessment design, contextual resources, and the quality of pedagogical scaffolding provided during implementation.

Although the intervention was associated with a statistically significant improvement in grammatical accuracy, therefore, the findings provide important implications for EFL grammar instruction since the reduction in grammatical errors suggests that COCA-assisted instruction can support learners' awareness of language patterns when integrated appropriately into classroom practice. Yet, corpus resources such as COCA should be positioned as complementary instructional tools rather than stand-alone teaching methods. Consistent with the principles of Data-Driven Learning (DDL), corpus exploration can enrich grammar instruction by exposing learners to authentic examples of language use; however, the benefits of such exposure appear to depend largely on how it is pedagogically mediated (Boulton & Cobb, 2017). The findings indicate that corpus consultation is likely to be more productive when combined with explicit grammar instruction, enabling learners to connect authentic language patterns with formal grammatical explanations and apply them more effectively in writing tasks.

From the perspective of Genre-Based Pedagogy and Systemic Functional Linguistics, grammar learning becomes more meaningful when linguistic forms are taught within authentic communicative contexts rather than as isolated rules (Halliday & Hasan, 2014; Nagao, 2019). The reductions observed in verb and article errors suggest that learners may have become more attentive to grammatical features commonly used in procedural texts. Consequently, corpus-based activities should be integrated with genre-specific writing instruction so that learners can observe how grammatical choices contribute to the communicative purpose and organization of a text. At the same time, the findings underscore the importance of guided noticing and teacher scaffolding. Many EFL learners, particularly those with limited experience in corpus consultation, may encounter difficulties in independently interpreting concordance lines and identifying meaningful linguistic patterns. Structured guidance, reflective discussion, and explicit modeling therefore remain essential for transforming exposure to authentic language data into deeper grammatical understanding. Such instructional support is consistent with the Noticing Hypothesis, which emphasizes conscious attention to linguistic forms as a prerequisite for language development (Leow, 2019).

Viewed more broadly, the findings suggest that the contribution of corpus-based instruction may extend beyond immediate improvements in test performance (Ayu et al., 2024). The observed reduction in grammatical errors, together with the substantial variation among learners, indicates that corpus-assisted learning may influence dimensions of language development that are not always captured through conventional grammar assessments. Grammatical awareness, pattern recognition, and sensitivity to authentic language use may emerge gradually as learners engage repeatedly with corpus data and genre-based writing activities. These processes are likely to be shaped by factors such as instructional duration, learner readiness, digital literacy, classroom support, and the educational context in which corpus resources are implemented. Accordingly, Al-Qahtani (2021); Özer & Şükrü Özbay (2022); Suhandoko et al. (2025) confirm that the pedagogical value of COCA appears to lie not only in providing authentic linguistic input but also in creating opportunities for learners to explore, reflect on, and apply grammatical knowledge in meaningful communicative contexts. In this regard, COCA-based instruction represents a promising component of contemporary EFL pedagogy, particularly when embedded within sustained, scaffolded, and context-sensitive approaches to grammar learning.

Consequently, rather than viewing COCA as a standalone solution for grammar instruction, it may be more appropriate to regard it as a promising supplementary resource whose effectiveness depends on careful instructional design, explicit teacher scaffolding, adequate technological support, and long-term integration into genre-based writing instruction. Within this framework, COCA can enrich EFL grammar learning by providing authentic linguistic input and fostering greater learner engagement with language patterns, while the present findings simultaneously underscore the opportunities and practical limitations associated with implementing corpus-based pedagogy in rural vocational classrooms.

CONCLUSION

This study aimed to examine whether COCA-assisted instruction could improve the grammatical performance of vocational high school students in an EFL context, particularly through learners' engagement with authentic language examples and recurring grammatical patterns. The study also sought to understand the potential contribution of corpus-based learning to learners' grammatical awareness and performance within a rural vocational educational setting. Therefore, the findings showed a statistically significant improvement between the pretest and posttest results following the COCA-assisted instructional intervention. A reduction in overall grammatical errors was observed, with particularly noticeable decreases in verb and article errors. These results indicate measurable

improvement in learners' grammatical performance after the intervention. The findings are consistent with the principles of Data-Driven Learning and the Noticing Hypothesis, suggesting that exposure to authentic corpus evidence may encourage learners to notice recurring grammatical patterns, compare linguistic forms, and apply their observations to writing.

The findings can be interpreted as evidence that COCA-assisted activities may support grammatical development by connecting learners with authentic examples of language use rather than relying exclusively on decontextualized grammatical rules. However, the improvement should not be interpreted as conclusive evidence that COCA alone caused the observed gains. Learner engagement, classroom instruction, repeated writing practice, instructional duration, technological conditions, digital readiness, and teacher scaffolding may also have contributed to the observed improvement. The paired-samples design therefore supports the interpretation of significant pretest–posttest improvement but does not establish an independent causal effect of COCA. Also, the findings have several implications for EFL grammar instruction since COCA may be used effectively as a supplementary resource within grammar and writing instruction, particularly when corpus exploration is combined with explicit explanation, guided noticing, teacher scaffolding, and genre-based writing activities. The rural vocational context further highlights the importance of adequate technological access, learner preparation, and sustained opportunities for corpus engagement. Future research should employ longer interventions and comparative or controlled designs to determine the extent to which COCA-assisted instruction independently contributes to grammatical development.

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The authors carefully reviewed, revised, and verified all AI-assisted content to ensure its accuracy, originality, and consistency with the objectives and scholarly standards of the study. The authors remain fully responsible for the content, accuracy, integrity, and quality of the final manuscript. All interpretations, analyses, conclusions, and intellectual contributions presented in this work are solely those of the authors and were developed in accordance with accepted ethical standards in academic research and publishing.

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INFORMED CONSENT STATEMENT

Participation in this study was entirely voluntary. Before participating, all participants were provided with clear information regarding the purpose, procedures, potential risks, and anticipated benefits of the research. Participants were informed that their personal identities would remain confidential and that all collected information would be used exclusively for research purposes. They were also informed of their right to withdraw from the study at any time without penalty or any loss of benefits to which they were otherwise entitled. By

agreeing to participate, participants provided informed consent under the ethical conditions established for this research.

DATA AVAILABILITY STATEMENT

The dataset generated and analyzed during this study is not publicly available due to ethical considerations and privacy protections related to participant confidentiality. Restricting public access ensures compliance with applicable ethical guidelines and data protection requirements. However, the dataset may be made available upon reasonable request from qualified researchers for purposes of verification, replication, or further scholarly analysis. Any request for data access will be evaluated on a case-by-case basis and will require approval from the relevant institutional ethics committee to ensure that the proposed use is consistent with participant consent and ethical research standards.

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